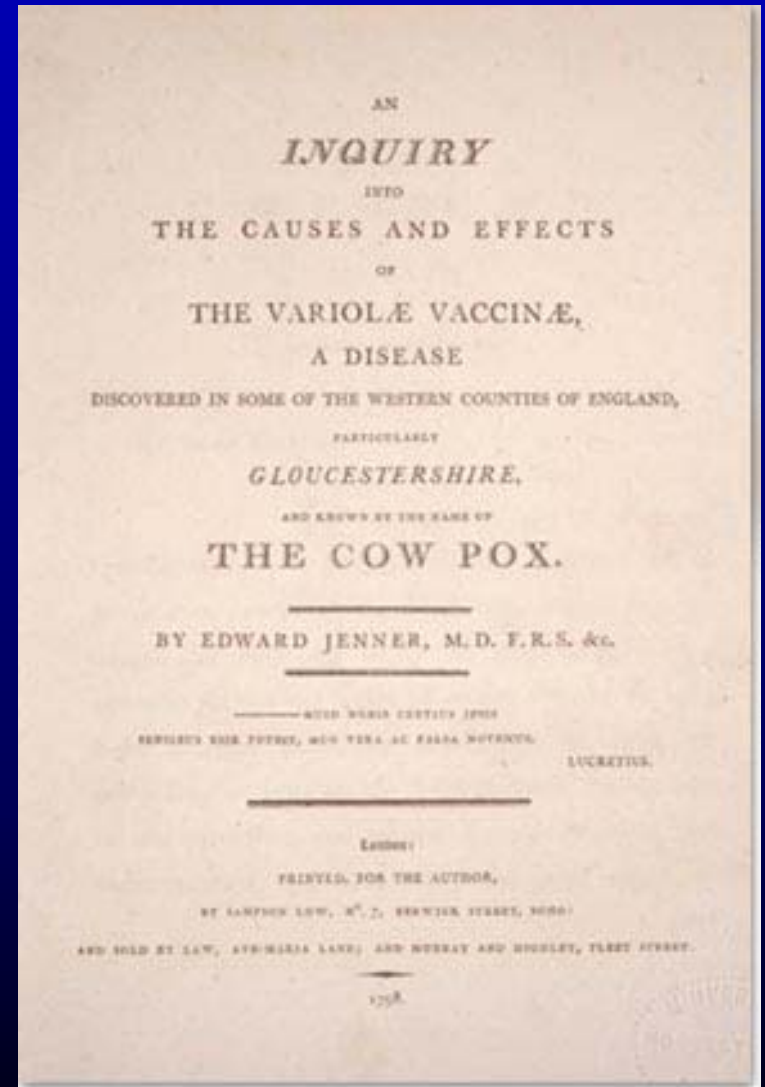


Smallpox Vaccine

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Smallpox Vaccine

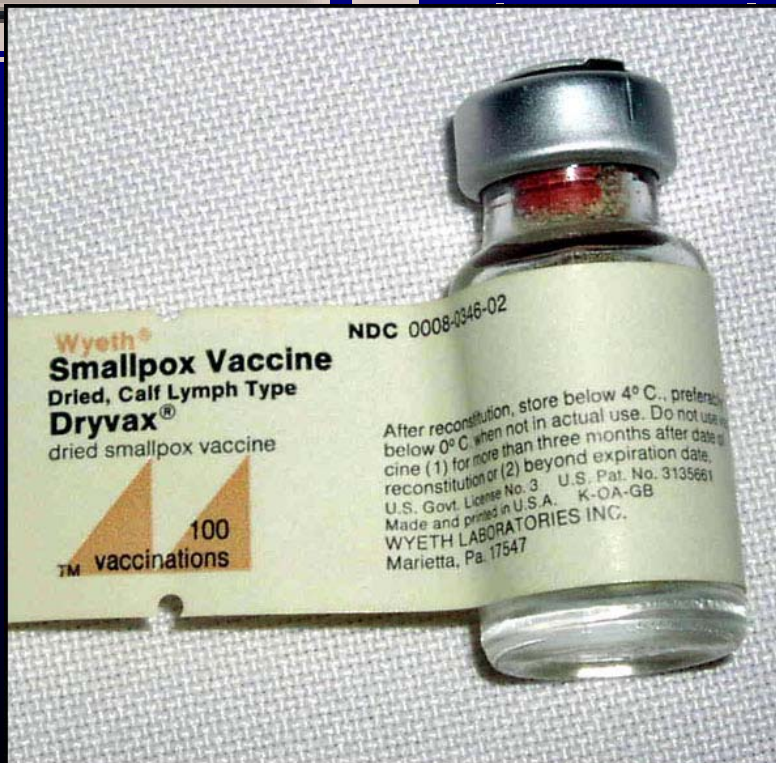
- Original material used by Jenner was probably cowpox
- Vaccine virus mutated from cowpox to vaccinia during the 19th century
- Vaccine available today includes Dryvax (licensed) and “Wetvax” (investigational new drug)
- Cell culture vaccine available within one year



Vaccine and Needle



Bifurcated Needle



- Smallpox vaccine contains live vaccinia virus (New York Board of Health strain)

Vaccination Technique



Duration of Immunity

- **High level of protection (~100%) for 3-5 years following vaccination**
 - **Prevent disease**
- **Substantial but waning immunity for ≥ 10 years**
 - **Reduction in disease severity**

Clinical Response to Vaccination



- **“Jennerian vesicle” at inoculation site**
- **Swelling and tenderness of lymph nodes under arm, usually during 2nd week**
 - **25%-50% of primary vaccinees**
- **Fever - up to 16%**
- **Muscle aches, headaches, chills, nausea or fatigue – up to 37%**

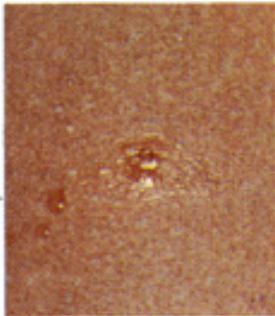
Clinical Response to Vaccination*

Symptom/sign	Time after Vacc
Papule (bump)	2-4 days
Vesicle (blister)	5-6 days
Pustule	7-11 days
Maximum redness	8-12 days
Scab	12+ days
Scab separation	17-21 days

***typical response in a nonimmune person**

Normal Response To Smallpox Vaccination

Day 0



Day 3



Day 7



Day 10



Day 14



Primary Vaccination



Revaccination

Transmission of Vaccinia

- **Vaccinia virus may be recovered from the site of vaccination from development of papule (3-5 days) until scab separates from the skin (17-21 days)**
- **Household members at highest risk of contact transmission**

Adverse Events to Vaccination

- **Common reactions**
 - **Local (up to 80%), systemic (25%), robust primary takes (5-15%)**
- **Less common reactions**
 - **Rashes, inadvertent inoculation, generalized vaccinia**
- **Uncommon reactions**
 - **Eczema vaccinatum, progressive vaccinia, encephalitis**

Complications of Smallpox Vaccination

- **Definitive studies of complications of smallpox vaccination by Lane et al, published in 1969***
- **Led to the recommendation to cease routine smallpox vaccination in the United States**

Lane JM, Ruben FL, Neff JM, Millar JD. Complications of smallpox vaccination, 1968. National surveillance in the United States. N Eng J Med 1969;281:1201-8.

Smallpox Vaccine Adverse Reaction Rates*

Reaction	Primary Vaccination
Inadvertent inoculation	25-529
Generalized vaccinia	23-242
Eczema vaccinatum	10-39
Progressive vaccinia	0.9-1.5
Post-vaccinial encephalitis	3-12
Death	1

***Rates per million primary vaccinations**

Adverse Events from Smallpox Vaccination

Today

- **Same vaccine as used in the 1960's – 70's**
- **Higher prevalence of persons with contraindications for vaccination (e.g., cancer, organ transplant, eczema or atopic dermatitis, HIV infection)**
- **Estimated that ~25% of persons would be excluded from vaccination due to contraindications or contact with person with contraindications**

Estimates of Populations with Contraindications to Smallpox Vaccination

Condition	Estimated Population
Recipients of solid-organ transplantation	~184,000
Cancer patients and survivors	~8.5 million
HIV infection	
Known diagnosis	550,000
Unknown	300,000
Atopic dermatitis	28 million
Other immunodeficiency conditions	?
Persons on high dose steroids or other immunosuppressive drugs	?

Adapted from: Eff Clinical Prac 2002; 5:84-90

Response Plans